π^0 spectra in d+Au and p+p collisions from $\gamma \rightarrow e^+/e^-$-conversions in the STAR TPC

A.A. Wetzler[1,2], K. Filimonov[1], P.M. Jacobs[1] and J.L. Klay[1] for the STAR collaboration

[1]*Nuclear Science Division, Lawrence Berkeley National Laboratory, Berkeley, California 94720*
[2]*Institut für Kernphysik, Johann Wolfgang Goethe-Universität, Frankfurt a. M., Germany*

The measurements of π^0 mesons in d+Au and p+p collisions at $\sqrt{s_{NN}} = 200$ GeV are presented. Photons, the decay products of the π^0s, are measured in the STAR TPC after they convert in the inner material of the detector or the TPC gas to e^+-e^--pairs.

To measure photons, the following procedure was used: e^+ and e^- tracks were selected from all measured tracks by loose cuts on their specific energy loss and the number of measured points on the track together with the requirement that low p_t tracks do not to point back to the event vertex. γ-conversions are topologically indentified by selecting pairs of e^+ and e^- tracks with a small opening angle at their point of closest approach. The secondary vertex is required to be well separated from the event vertex, to which the reconstructed photon candidate is required to point back.

π^0s are identified on a statistical basis by combining two photons and calculating the invariant mass of the pair. The signal to background ratio in d+Au collisions is about 4 : 1 before the background is subtracted using a mixed event method [Fig. 1]. The analysis method is described in detail in [1].

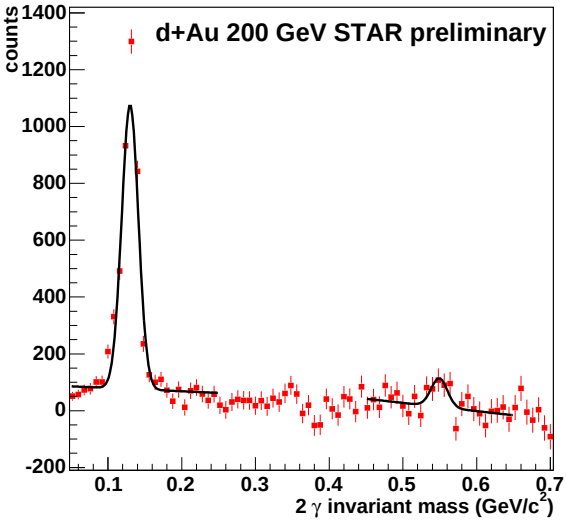

FIG. 1: Invariant mass spectrum of 2γ-pairs after subtraction of the combinatorical background determined from a mixed events method. The π^0 and η peaks are fitted by gaussians.

The raw π^0 yields as a function of p_t for minimum bias d+Au and p+p collisions shown in Fig. 2 were obtained by counting all entries with an invariant mass of 110 – 150 MeV/c^2 after background subtraction. The data are not yet efficiency corrected. The rapid drop at low transverse momentum is due to the limited tracking efficiency for particles at low p_t. The spectra extend in p_t up to 4 GeV/c for p+p and up to 5 GeV/c for d+Au collisions. Analyses with the γ-conversion technique at higher p_t are limited by statistics only.

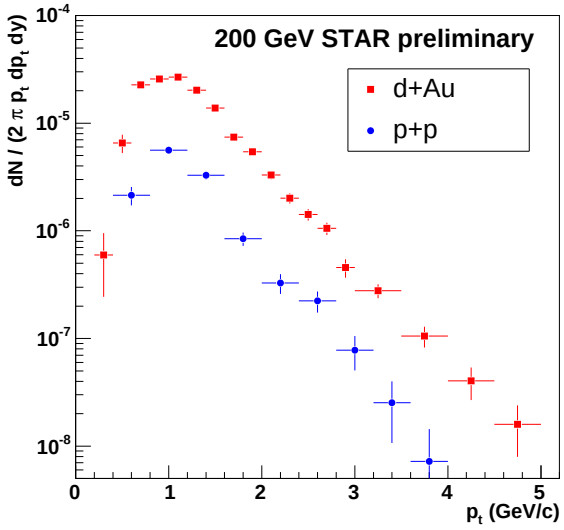

FIG. 2: Preliminary π^0 spectra measured in d+Au and p+p collisions. The data are not yet corrected.

Upon completion of the analysis, the comparison of the π^0 spectra measured in d+Au and p+p collisions as well as of the π^0 to the charged hadron spectra in these data sets will be possible. The results will serve as a reference for the future measurements in Au+Au collisions at $\sqrt{s_{NN}} = 200 GeV$. As the π^0 is one of the main sources for photon production, a detailed knowledge about its spectra together with a photon measurement obtained using the same analysis technique will allow an estimate on the direct photon spectra.

[1] J. Adams et al. (STAR) (2004), nucl-ex/0401008.